NEW BRACHIOPODS OF THE GENUS SPIRIFER FROM THE SILURIAN OF MAINE.

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The species described in the following paper are particularly interesting because of the relations they bear to well-known Silurian forms while retaining a distinctive distribution of their specific characters not heretofore observed.

The fauna with which they are associated indicates a closer relationship to the Wenlock-Ludlow formations of Great Britain than to the Niagara of the interior of the American Continent.

Their source is the Edmunds formation of Washington County, Maine.

SPIRIFER (?DELTHYRIS) TRESCOTTI Williams.

Plate 1, figs. 1–9, 11, 20, 22–23, 25.

1828, cf. *Delthyris elevata* Dalman Vet. Acad. Handlingar fur 1827, p. 120, pl. 3, fig. 3.

1867, cf. *Spirifera elevata* Dalman, Davidson, British Silurian Brachiopoda, pt. 7, No. 2, p. 95, pl. 10, figs. 8, 9, and 11.

In external appearance the adult shells of this species resemble Davidson's figures of "*Spirifera elevata* Dalman" shown on his plate 10, figures 8, 9, and 11 in British Silurian Brachiopoda.

It is necessary to examine critically his definition in order to discover the points of difference. The following portions of Davidson's description of "*Spirifera elevata* Dalman" may be used as they were written in defining the form here under consideration:

Transversely rhomboidal, hinge line nearly (____(*a*)____) as long as the width of the shell, cardinal angles (____(*b*)____) rounded. Dorsal valve less convex than the opposite one with (____(*c*)____) simple ribs, which are divided by a mesialfold, equaling in width the adjoining two ribs, moderately elevated and grooved along the middle. Ventral valve much arched and gibbous; beak incurved; mesial sinus as wide as the fold of the opposite valve and margined by a strong rounded rib or ridge on each side; ____four____ ribs on either side of the sinus. Surface of both valves regularly crossed by numerous slightly

projecting lines, as well as by delicate longitudinal and transverse striæ. Area triangular (____(*d*)____), fissure (____(*e*)____). Specimens vary much in size (____).[1]

The omissions marked by dotted lines above, are parts of the description which do not apply to *S. trescotti.* The differentiating characters are therefore found in the following particulars: (*a*) The hinge line does not quite reach the full width of the shell in our specimens. (*b*) The cardinal angles are rounded or slightly angular. (*c*) The plications on the brachial valve vary with size of the shell, additional plications making their appearance at the cardinal angles with development of the shell. The smallest specimen in evidence (see pl. 1, figs. 2 and 4) is 5 millimeters wide and shows one plication each side the median fold of nearly the size of the fold, and a second one faintly expressed outside the first. The cardinal extremities are broadly rounded, presenting the form of *Spirifer crispus*, var. *simplex* Hall. A specimen about 7 mm. wide (H. S. W. Cat. No. 1429.2) shows three plications each side the fold and the fold is distinctly broader than the first plication; the extremities are rounded. Specimens 8 or 9 mm. wide have the extremities slightly angular and four plications (and in one specimen a faint fifth) are seen each side the fold. Larger specimens, up to the largest seen (17 mm. wide), show only four well defined and faintly a fifth plication each side the fold. The fold in the smaller as in the larger specimens shows the "groove along the middle" described by Davidson as characteristic of *S. elevata* Dalman. The pedicle valve shows but four well-defined plications each side the sinus which, at the front of the larger specimens, is quite broad, equaling the distance from first to third plication. The small pedicle valves differ from *S. crispus* in the high, strong, and overarching beak, and a specimen 6 mm. wide, a mold of the interior of a pedicle valve, shows a distinct septum as in adult specimens. (*d*) The triangular area of the pedicle valve is not broad but is undefined, as shown by Whitfield in figures of *Spirifer crispus* and *S. vanuxemi*[2], and slopes gradually off into the sides of the shell without any sharp angle defining its limits. Specimens showing this character are molds of the interior, and it is therefore possible that the limits are more sharply defined exteriorly as expressed by Davidson's figures. (*e*) The fissure (delthyrium) is narrow and high (see pl. 1, fig. 20), and no case of a pair of deltidial plates has been discovered on our specimens. Davidson mentions them in his description, but none of his figures show them.

The dental plates of the pedicle valve are thin and elongate. In small as well as large specimens there is a thin, deep median septum reaching halfway from beak to front. The surface is covered by

[1] Brit. Sil. Brac., p. 95.
[2] Pal. New York, vol. 8, pt. 2, pl. 36, figs. 2 and 11.

regular fine lamellose lines fringed at their outer edges by fine interrupted radial lines. Molds of the interior of some brachial valves show a faint linear depression (elevated line in shell) in the umbonal portion of the mold.

From the above description it will be seen that the shell closely resembles Davidson's narrower forms of *S. elevata* Dalman.

Formation.—Edmunds formation (Silurian).

Locality.—Northeast corner of Crowe Neck, Trescott Township, Washington County, Maine.

Cotypes.—Cat No. 61451, U.S.N.M.

Remarks.—It is known that specimens identified as *Delthyris elevata* Dalman possess a median septum in the pedicle valve which has led to the adoption of that species as the type of the genus Delthyris.[1] It is not established, however, either that Dalman recognized that character in his descriptions or that the type-specimens possessed this distinction.

Lindstrom, in his description of the species from Gotland,[2] makes no mention of the median septum. (The writer is indebted to Mr. Hermanson, of Cornell University, for the translation of this description.) The discovery in the Edmunds formation of Maine of the two species here defined (which externally are very close to the form called *Delthyris elevata* Dalman from Gotland and *Spirifera elevata* Dalman of Davidson from the Wenlock of England, but differ from each other by the possession of a well-defined median septum in one, i. e. *Sp. trescotti*, and its absence in the other, i. e. *Sp. cobscooki*, leaves us in doubt as to the validity of the generic characters of *Delthyris* Dalman.

Davidson's conception of the species, as above quoted, appears to be based upon external characters, and we note no mention of a median septum in his description or figures.

Wenjukow,[3] in citing the species from the Silurian of Podolia, seems to base the identification upon external characters alone.

In all these definitions of the species *Delthyris* (or *Spirifera*) *elevata* Dalman the groove along the middle of the fold of the brachial valve is noted as one of the specific characters.

In the various specimens here under investigation it is noted that those forms in which the fold of the brachial valve is grooved (viz, *Spirifer cobscooki*) have no median septum in the pedicle valve and those forms possessing the median septum have no groove along the middle of the brachial fold. While it does not necessarily follow that the combination of characters expressed by species in Maine should be the same as in species of the same approximate age in Got-

[1] Schuchert. Syn. Amer. Foss. Brach., Bull. U. S. Geol. Surv., No. 87, 1897, p. 206.

[2] Ofersigt. Kgl. Vet. Akad. Forhandlinger, 1860, p. 359–360.

[3] Wenjukow, T., Die Fauna der Silurischen Ablagerungen des Gouvernments Podolien, 1899, p. 129, pl. 11, figs. 3, 4, and 5,

land, England, and Podolia the validity of the establishment of the genus *Delthyris* upon Dalman's species *D. elevata* will rest upon the proving that that species combines in the same shell the median septum of the pedicle valve with the groove along the middle of the fold of the brachial valve.

SPIRIFER COBSCOOKI Williams.

Plate 1, figs. 10, 12, 21, 24.

1905. *Spirifer octocostatus* Hall, WILLIAMS, U. S. Geol. Surv., Prof. Paper No. 35, pp. 22, 23.
Cf. *Delthyris elevata* DALMAN.

A spirifer of the general form of *Delthyris elevata* Dalman with high area, overarching beak, four plications each side the fold of the brachial valve which is indented by a median groove extending from beak to front. The interior of the pedicle valve has no median septum.

The original specimens were identified in 1905 with *Spirifer octocostatus* Hall,[1] by Williams and probably by Shaler, as the name is given in his list of 1886,[2] though the specimens are not labeled. But they differ from that species both in the absence of a median septum in the pedicle valve and by the presence of the groove along the top of the brachial fold. The species attains a larger size than *Spirifer trescotti* Williams from the same formation, and the surface markings are similar. The possession of a strongly developed median septum, however, distinguishes *S. trescotti* from this species.

The type-specimen of *S. cobscooki*, represented on plate 1 by figure 21, shows a cardinal view in mold of the two valves in conjunction. The dimension of this specimen across the cardinal area is 19 mm., the height from center to center of the two valves at the beaks is 14 mm., the width of the delthyrium at the cardinal base 5 mm. Four complete plications are in evidence each side the sinus of the pedicle valve; where the area meets the outer surface of the pedicle valve the angle is rounded. Another specimen (pl. 1, fig. 10), a mold of the interior of a pedicle valve, shows the sinus to the tip of the beak and without trace of the median septum. Still another specimen (pl. 1, fig. 12), a mold of the interior of the brachial valve, shows the groove on the fold extending from beak to front. The surface sculpture consists of fine concentric lamellose lines, fringed at their edges by fine interrupted longitudinal lines. The figure (pl. 1, fig. 24) illustrating this character was photographed from a gutta-percha mold of the specimen, which is a mold of the exterior and only imperfectly exhibits the interrupted lines at edges of the concentric lamellae.

[1] Prof. Paper No. 35, U. S. Geol. Surv., 1895, pp. 22–23.
[2] Amer. Journ. Sci., ser. 3, vol. 32, p. 58.

The two species together (*S. trescotti* and *S. cobscooki*) fairly well represent the characters generally ascribed to Dalman's species *Delthyris elevata*, but the first, with a median septum in the pedicle valve, lacks the groove in middle of the brachial fold, and the second, having the groove, lacks the median septum. Until further light is thrown on the matter the three species may be regarded as distinct though very closely related.

Formation.—Edmunds formation of the Silurian.

Locality.—South of Bells Mountain, on west shore of Cobscook River, Edmunds Township, Washington County, Maine.

Holotype and paratypes.—Cat. No. 61452, U.S.N.M.

SPIRIFER EDMUNDSI Williams.

Plate 1, figs. 13, 14, 15.

1905. *Spirifer* cf. *perlamellosus* Hall, WILLIAMS, Prof. Paper U. S. Geol. Surv. No. 35, pp. 22, 23.

Specimens described under the name *Spirifer edmundsi* differ from *S. cobscooki* in the following particulars: They are larger in size, have a greater number of plications (6 and 7 instead of 4 and 5, respectively, on each side of the brachial and pedicle valves), a lower area, and more angular cardinal extremities. The two species agree in lacking a median septum in the pedicle valve and in possessing a groove in the middle of the brachial fold.

Spirifer edmundsi closely resembles some figures of Hall's species *S. perlamellosus*, as will be seen upon comparing our figures 13, 14, 15 on plate 1 with Hall's figures on plate 26.[1]

The type-specimen (pl. 1, fig. 13) was about 28 mm. from tip to tip of cardinal margin. The corner on the left is broken off in the specimen. Hall's figure 1*y* of *S. perlamellosus* measures 27 mm., and the several figures given on his plate 26 vary from 10 to 45 mm.

The cardinal extremities of our specimen are closely similar to those of Hall's figure 1*n*. The plications on right side of figure 13 are 7; those on Hall's figure 1*n* are 6 on left and 5 on right side.

The brachial valve (pl. 1, fig. 14) shows 6 plications on the right of the fold; Hall's figure 1*p* shows 6 plications each side the median fold. The surface markings are similar in the two species. The area is flat and extended as in Hall's figure 1*m*.

Spirifer edmundsi differs from *S. perlamellosus* in the possession of a well-defined groove along the middle of the brachial fold from beak to front of the shell and in the absence of any trace of median septum in the pedicle valve, which is present in *S. perlamellosus*.

Formation.—Edmunds formation of the Silurian.

Locality.—South of Bells Mountain, on the west shore of Cobscook River, Edmunds Township, Washington County, Maine.

[1] Paleontology of New York, vol. 3, pl. 26.

Holotype and paratypes.—Cat. No. 51453, U.S.N.M.

Remarks.—In the list of species given by N. S. Shaler as from the Orange Bay section and from locality on the west side of Orange or Whiting Bay, about half a mile south of Balls Mill,[1] the species *Spirifer perlamellosus* Hall is cited. The writer had occasion to examine the collections made by Shaler and, although the specimens were not labeled, recognized specimens which closely resembled Hall's species. These were reported in a revised list of the collection under the name *Spirifer* cf. *perlamellosus* Hall.[2] The specimens so identified and others obtained in course of preparation of the Eastport Folio are here described under the specific name *Spirifer edmundsi* Williams.

SPIRIFER (cf. CYRTINA) LUBECENSIS Williams.

Plate 1, figs. 16–19, 26–28.

Shell cyrtiniform, pedicle valve, plicated with high, nearly flat and erect cardinal area. Fold and sinus wide at front. A pedicle valve 2½ cm. wide measures 1½ cm. from beak to front. A brachial valve of about the same width is about 12 mm. from beak to front.

Teeth plates of pedicle valve thin, extend one-third way to front, and a median septum cuts the sinus to three-quarters way to the front in a mold of the interior. Beak sharp and angular; area, high and triangular, flat and slightly overarching at the tip. Edge of area nearly straight and rounded at junction with the sides. Median sinus shallow, broadening toward front, and produced toward opposite valve; plications, counting the outer edge of the sinus as one, seven each side the center. Delthyrium narrow and apparently uncovered.

The brachial valve is gently curved from beak to front, fold prominent and separated from the plications by a furrow stronger than the furrows between the plications; a shallow groove cuts the middle of the fold.

The surface is badly preserved in all specimens, though faint evidence of lamellose concentric lines is seen on some. It is not possible from the specimens to determine whether or not there was punctate structure. The general form and the septum suggest that it may belong to the genus *Cyrtina*.

The form varies considerably, which is probably the result of distortion through movement in the rock mass after fossilization.

Formation and locality.—Black limestone at station 6.52.6B, believed to belong in the Edmunds formation, Lubec Township, Washington County, Maine.

Cotypes.—Cat. No. 61454, U.S.N.M.

[1] Amer. Journ. Sci., ser. 3, vol. 32, 1886, p. 52.
[2] Prof. Paper No. 35, U. S. Geol. Surv., 1905, pp. 22–23.

EXPLANATION OF PLATE 1.

All the figures are natural size except figures 2 and 24 magnified 2 diameters, and figure 9 magnified 3 diameters.

Spirifer trescotti Williams.

FIG. 1. Mold of the interior of a mature pedicle valve showing the plications, dental plates, and median septum.

FIG. 2. An immature specimen of the brachial valve, enlarged two diameters (shown natural size on lower left hand corner of fig. 4). This specimen shows resemblance to *Spirifer crispus* Hisinger.

FIG. 3. Mold of the interior of a mature pedicle valve.

FIG. 4. Molds of the interior of the beak portion of a mature pedicle valve and of an immature brachial valve. (See fig. 2.) The pedicle valve shows the dental plates and median septum.

FIG. 5. A small specimen showing the brachial valve and hinge area of the pedicle valve drawn from a gutta-percha impression. The beak of the pedicle valve is less developed than in mature shells.

FIG. 6. Mold of the interior of a pedicle valve not fully mature. The center of view is higher up on the umbonal portion of the shell than for figure 1, causing the shell to appear shorter from beak to front than normal.

FIG. 7. Mold of the exterior of a pedicle valve showing the rounded plications crossed by fine concentric lines.

FIGS. 8 and 11. Two views of mold of the interior of a brachial valve showing the number and form of the plications, the rounded median fold, and the form of the hinge border.

FIG. 9. Mold of the interior of a small brachial valve magnified three diameters.

FIG. 20. Interior cardinal view of a pedicle valve, showing the triangular area rounded off at sides, the narrow delthyrium, and the edge of the median septum where the beak is broken off.

FIG. 22. End view of same specimen as figure 20.

FIG. 23. Another view of same specimen, showing plications and contour of the pedicle valve.

FIG. 25. A slightly crushed brachial valve.

Formation.—Edmunds formation of the Silurian.

Locality.—Northeast corner of Crowe Necke, Trescott township, Washington County, Maine.

Spirifer cobscooki Williams.

FIG. 10. Mold of the interior of a pedicle valve of ordinary size, showing the five well-developed plications, each side the sinus, the absence of a median septum and the short development of the dental plates.

FIG. 12. Mold of the interior of a mature brachial valve, showing the plications and the well-developed furrow in the middle of the fold and extending from beak to front.

FIG. 21. Cardinal view of a specimen, showing both valves, the high overarching area and beak, the triangular delthyrium, absence of a median septum in pedicle valve, and trace of the furrow along the top of the brachial fold.

FIG. 24. Mold of the exterior of a piece of a brachial valve enlarged two diameters to show the fine concentric lines crossing the plications and the distinct median furrow on the fold.

Formation.—Edmunds formation of the Silurian.

Locality.—West shore of Cobscook River, about half a mile south of Bells Mountain, Edmunds township, Washington County, Maine.

Spirifer edmundsi Williams.

FIG. 13. Mold of the exterior of a pedicle valve. The drawing was made from an impression of the opposite side of same specimen represented by figure 15 and shows the plications more in number than in *S. cobscooki* (see fig. 10).

FIG. 14. Mold of the interior of a brachial valve, showing the plications and furrow along the top of the fold.

FIG. 15. Mold of the interior of same specimen represented by figure 13, showing the relatively low area and the absence of a median septum.

Formation.—Edmunds formation of the Silurian.

Locality.—West shore of Cobscook River, about half a mile south of Bells Mountain, Edmunds township, Washington County, Maine.

Spirifer lubecensis Williams.

FIG. 16. An end view of a pedicle valve, showing the high, pointed beak and nearly straight cardinal area.

FIG. 17. Mold of the interior of a pedicle valve, showing the plications, the broad shallow median sinus, and the angular beak with its nearly straight sides. Another view of same specimens as figure 1.

FIGS. 18 and 19. Two views of another specimen, showing the cardinal area, delthyrium, and slightly overarching beak.

FIGS. 26 and 28. Two specimens of brachial valves, both of them imperfect and distorted by crushing of rock after they were imbedded.

FIG. 27. The exterior surface of a pedicle valve, faintly exhibiting surface sculpture of concentric lamellose lines.

Formation.—Edmunds formation of the Silurian.

Locality.—Lubec township, Washington County, Maine.